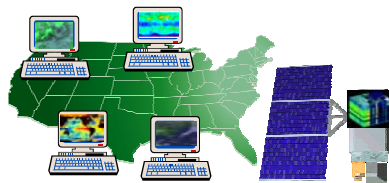
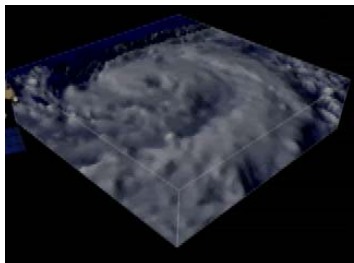
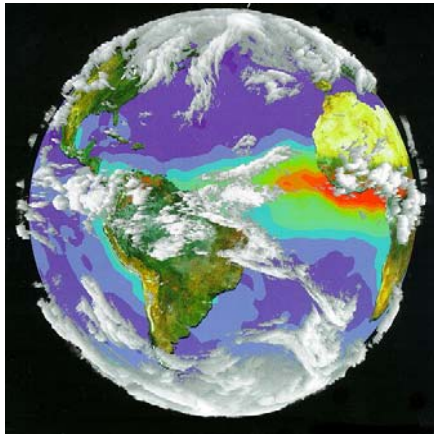
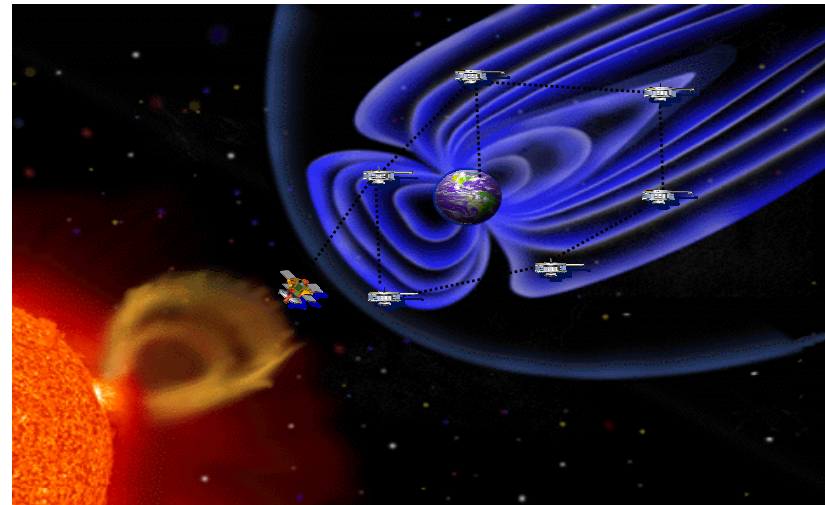




Information Systems Division / 580



Interoperable Models



Advanced flight and scientific information systems will support the execution and analysis of the scientific measurements and observations of the Earth and the Sun-Earth system.

November 25, 2003
All Hands Meeting

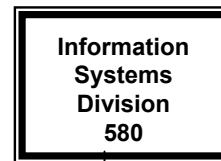


Agenda

- **Organization and Personnel Updates**
- **Software “Look Back” Survey**
- **CMMI Progress**
- **Technology Activities**
- **ISD Mission & Vision**
- **Summary Observations**



Information Systems Division (ISD/580) Organization



C: Joe Hennessy
AC: Martha Chu
AC: Vacant

Assistant Chief
for Technology

Peter Hughes

Systems
Integration and
Engineering
581

BH: Margaret Caulfield
ABH: Vacant

Flight
Software
582

BH: Elaine Shell
ABH: Ray Whitley
ABH: Kequan Luu
ABH: Ronald Zellar

Mission
Applications
583

BH: Henry Murray
ABH: Scott Green

Realtime
Software
Engineering
584

BH: John Donohue
ABH: Ryan Turner

Computing
Environments &
Technology
585

BH: Howard Eiserike
ABH: Steve Naus

Science Data
Systems
586

BH: Mike Seablom
ABH: Bob Lutz

Adv Data
Management
and Analysis
587

BH: Jim Byrnes

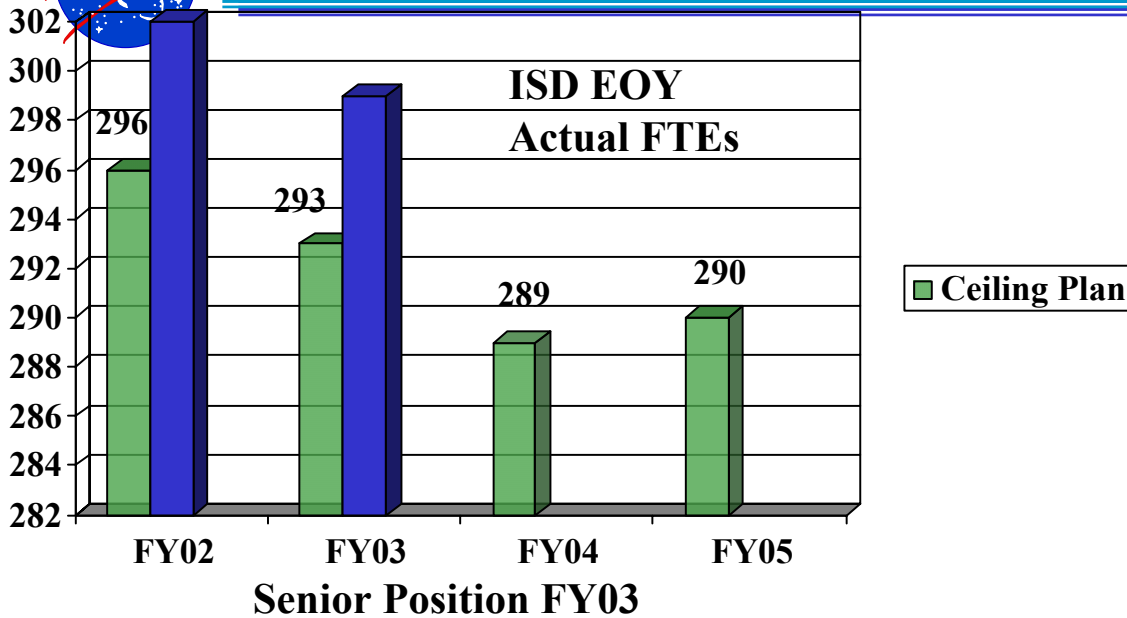
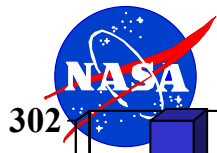
Advanced
Architectures
& Automation
588

BH: Julie Loftis
ABH: Barbie Medina

Wallops Systems
Software Eng.
589

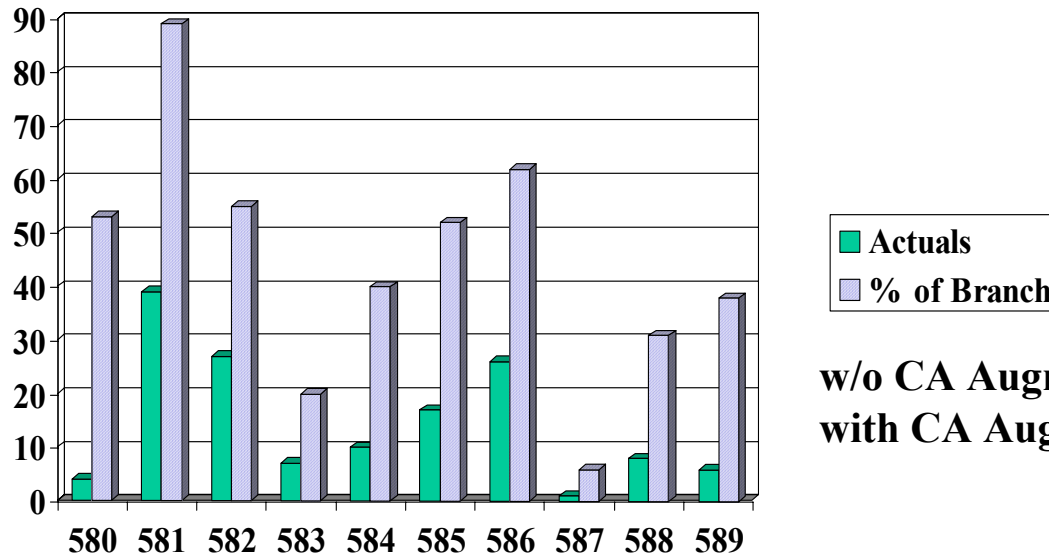
BH: Leigh Gatto

ISD Ceiling & Senior Positions Look



FY03 Initial Allocation 132; Actuals as of 10/03 130

Class Action (CA) Augment 16 Total 146



Senior Hire & Accretes*

CODE	FY01	FY02	FY03
580	0	1+0	0
581	3+0	2+0	0
582	2+1	3+1	0
583	0	0	0
584	0	1	0
585	0	0	0
586	0	1	0
587	0	0	0
588	0	0	0
TOTAL	6	9	0

* - w/o 3 NEX positions

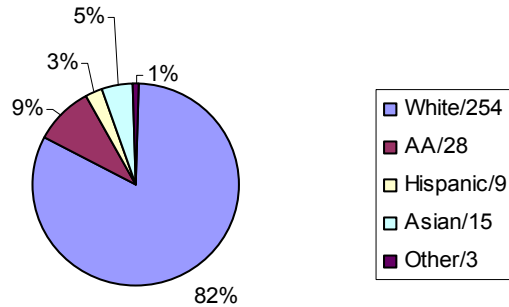
- Non-CA

w/o CA Augment: 87 GS 14s and 43 GS 15s
 with CA Augment: 97 GS 14s and 49 GS 15s,
 or 16 + 6 promotions

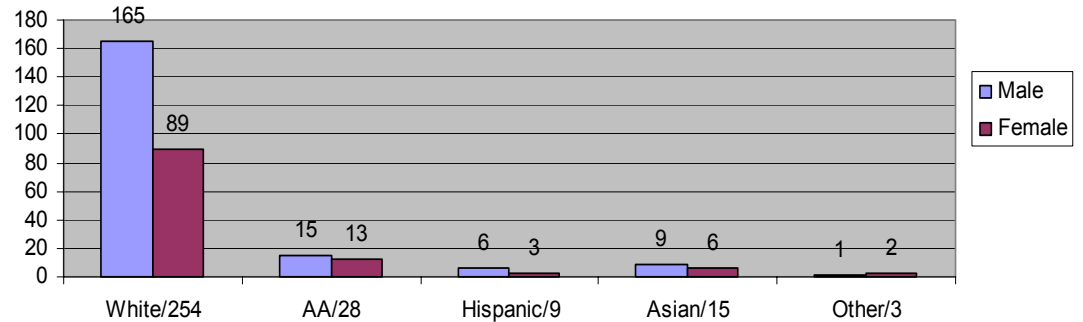


580 FY01 & FY02 Demographics

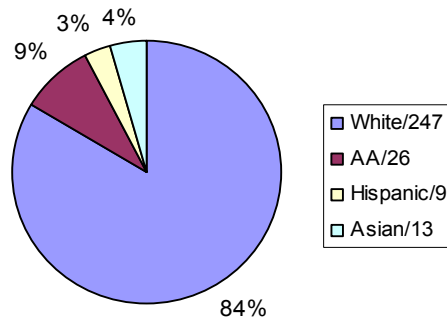
**580 FY02 Demographics
(309 Employees)**



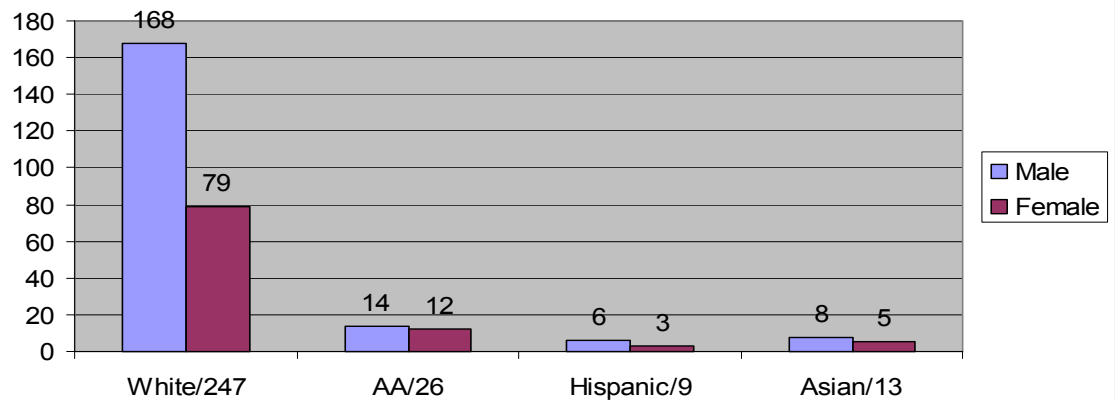
580 FY02 Male/Female (37%) Population



**580 FY01 Demographics
(295 Employees)**



580 FY01 Male/Female (34%) Population





10/03 AETD & ISD PROFILES

AETD

ISD

BREAKDOWN FOR ALL:

All AST Engineers	1049	100%
Supervisors	101	~10%
Senior Staff	37	~3.5%
Instr. Mgrs/Sys. Eng.	107	~10%
Sr. Hands-On Tech. Eng.	372	~35%
13 and Below Eng.	432	~41%

All Non-Admin	283	100%
Supervisors	20	~7%
Senior Staff	1	-
N/A	-	-
Senior Tech	146	~51%
13 and Below	116	~41%

BREAKDOWN OF SENIOR ENGINEERS:

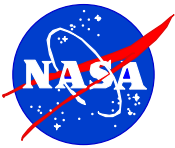
Total (Sup. – Sr. Hands On)	617	
Supervisors	101	~16%
Senior Staff	37	~6%
Instr. Mgrs/Sys. Eng.	107	~17%
Hands-On Tech	372	~60%

Total	167	
Supervisors	20	~12%
Senior Staff	1	-
N/A	-	-
Senior Tech	146	~87%

HANDS-ON ENGINEERS ONLY:

Total Tech Eng.	804	
Sr. Hands-On Tech.	372	~46%
13 and Below	432	~54%

Total Tech	262	
Senior Tech	146	~56%
13 and Below	116	~44%



Optimistic '04 Hire Picture

	Code	Non FOut	Coop Cnv	FOuts	Corp. FOs	SpclTerms	
					1		
	581	2	0	0	0	0	
	582	2	1	1	1	1	
	583	0	1	1	0	0	
	584	0	0	1	0	0	
	585	0	0	1	0	0	
	586	0	1	1	0	1	
	587	0	1	2	1	0	
	588	1	0	2	0	0	
	589	0	1	1	0	0	
Totals:		5	5	10	3	2	25



Notable/Near-Term Personnel Actions...

Mary Ann Esfandiari has transferred to Code 400. The ISD Associate Chief opening is presently posted.

Ken Rehm was selected for the JWST Mission Systems Software Architect Position. The plans for a JWST Division Office were halted in response to new JWST Project management's organizational style.

Leigh Gatto was selected Head of the Wallops Systems' Software Engineering Branch.

John Donohue was selected to lead the Realtime Software Engineering Branch.

Ryan Turner/584 and Bob Lutz/586 were selected as Associate Branch Heads.

The Code 581 Associate Branch Head is in-process of final selection.

ISD Class Action results were positive, with 16 promotions to grade 14 and 6 promotions to grade 15. These were all accretions and have no long-term implication to our senior position allocation of about 130.



... and ISD FY03 Excellence Recognition

- **Engineering Excellence Awards**
 - **JP Swinski/582 for outstanding MLA flight software contributions**
 - **Gail McConaughy/586 for ES Vision & ES Data Systems Strategic Evolution and for Intelligent Data Understanding efforts**
 - **Hayden Gordon/CSC @ WFF for invaluable contributions to ADEOS-II, WOTIS, the SA/11m Subcontract, and RADAC**

- **Best Technical Paper Awards**
 - **Lori Enright/588 for “Automation of Coordinated Planning Between Observatories: The Visual Observation Layout Tool”
(co-authored by Anuradha Koratkar of the HST ScI)**
 - **With Dan Mandl/584 & Jerry Miller/586 as runner-ups for “Validation of Onboard Cloud Cover Assessment Using EO-1”**

- **Technology Leadership Award**
 - **Mike Seablom/586 for authorship of “An Architecture Study for a Sensor Web Simulator”, a winning Revolutionary Aerospace System Concept proposal, and for his efforts in the Weather Architecture Study exploring sensor-web technologies to improve 3 to 5 day forecasts.**



... and External Excellence Recognition

- **Dan Mandl/584 was recognized with the FY03 AETD Science & Technology Advancement Award for technical leadership in advancing technology infusion using the EO-1 platform**
- **Kathi Thomas/586 was recognized with the FY03 AETD Excellence in Diversity Award**



Answering The Call ...

GSFC/Division Critical MLA FSW Augment

**Pat Hennessy, Eve Rothenberg, Barbara Milner, Bob O'Brian/584;
Tina Tsui, Chris Durachka/585; and Walt Moleski/588**

R&TD Adaptive Sensor Fleet Initiative

**Jeff Hosler/588; Pat Hennessy/584; Roger Abel/583; Pam Pittman/589;
Dave McComas/582; Kara Chapman, Steve Talabac/586; ...**

And ...

Lori Enright/588 for GMSEC TRMM reengineering

Bob Dutilly/581 for trying a FSW role

Jeff Hosler/588 for IMDC support, an atypical 588 role



GSFC Mission Critical Software “Look-back” Survey



“Look-Back” Study Overview

- **Study conducted in 2003 to obtain a quick snapshot of two areas**
 - **Software cost growth (percentage and growth areas)**
 - **Software errors**
- **Fourteen projects/instruments examined**
 - **Seven flight software**
 - **Seven ground software**
- **Selection of targeted missions/instruments based on readily available knowledge, data, and personnel:**
 - **Quick snapshot approach did not allow in-depth research and analysis**
 - **Each project software point-of-contact completed survey form and met once with study team**
- **Study objectives patterned after those conducted in 2000 JPL study**
(Flight Software Cost Growth: Causes and Recommendations, February 2000, J. Hihn, H. Habib-agahi)



Study Data

- **Survey attempted to collect project information on:**
 - **Overall software cost growth as a percentage of planned cost**
 - **Allocation of the cost growth across ten predefined growth areas**
 - **Growth areas based on those identified in JPL study**
 - **Possible areas included Experience, Teaming, Planning, Requirements, Design, Testing, Inheritance, Tools, Methods, and Staffing**
 - **Ranking of typical causes of software errors as they applied to Project software**
 - **Each cause ranked from most significant (1) to least significant (5)**
 - **Possible causes included Requirements, Software Design, Software Interfaces, Coding/Computation, and Environment**
 - **Overall size of project software in lines of code**
 - **Total effort spent on project software development in staff-years**
 - **Classification of requirements stability at various lifecycle milestones**



Software Growth ... Range and Average

	All Flight SW	Ground SW	All SW	Flight SW Tech Basis
Average Growth	36%	14%	24%	15%
Lower Sample	- 10%	10%	- 10%	- 10%
Upper Sample	90%	20%	90%	50%

All figures discount IRAC FSW and Technical Basis eliminates Project budget dictated FSW variances.



Flight Software Cost Growth

Comparison of Baseline/Approved/Actual Flight Software Cost (SYs)

•Project *- Instrument	•FSW Baseline Cost Estimate	•Project Approved Funding	•Final Cost
S/C C&DH	12 [†]	12	19.8
InHouse SI*	3.5 [†]	3.5	12.1
C&DH and ACS	73 (FSW Branch)	73	74
InHouse SI*	18 (FSW Branch)	14	21(?)
S/C C&DH	35 (FSW Branch)	35	31.5
C&DH and ACS	28 [†]	28	53.2
InHouse SI*	16.5 (FSW Branch)	14.6	20 & growing (final est. ~30)

Litton Ind. to
I&T start

Firmware to
make it cheap &
shift from FBC.

LANL science
code challenge

[†] Estimates dictated by Project budget limitations & allocations assessment process.
Baseline set by budget and not a technical assessment.



Source of Software Errors: Ordinal Ranking

Software Error Source	Flight SW	Ground SW	All SW
Requirements	2	4	3
Design	4	4	4
Interfaces	2	1	2
Code	1	2	1
Environment	5	3	5

Note: This study did not examine the correlation between sources of errors and cost



General Conclusions

- **General Study Conclusions**
 - **Ground software growth appears to be consistent (10 to 20%)**
 - **Flight software growth varies more widely (-10 to 90% or 50%)**
 - **Mission ground software is generally at a higher level of product maturity than flight software (i.e., greater potential for reuse)**
 - **New ground software development is generally minimized to limit overall ground system development costs, while flight software requirements typically translate to required new code**
 - **Flight software growth appears to be affected by earlier lifecycle activities (e.g., Project constraints, requirements stability, experience of team), while ground software growth is more evenly distributed throughout lifecycle**
 - **Highest error counts in both flight software and ground software are attributed to software interfaces and logical/computational coding errors**



Quick Look Reviews

- **Conducted three separate MESSENGER Mercury Laser Altimeter (MLA) Quick Look Reviews**
- **Conducted Swift Quick Look Reviews**
 - **UVOT, XRT, and S/C (non-ACS)**
 - **4 separate BAT reviews**

The MLA and BAT reviews and consequent actions proved very effective in focusing Project attention & limited resources and in establishing strategies to meet mission level intermediate needs (QLRs are typically 1/2 day focused on suspect areas, chaired by GSFC's Chief Eng with AETD & FPPD support)

The availability of the QLR is one tool that one can use to flag unrealistic baselines.



Recommendation

- **Key Recommendation**
 - **Adequately fund and execute the current Center Software Process Improvement initiative, with specific focus on its process documents, tools, guidelines and templates***
 - **Applicable examples addressing study findings include:**
 - **Project Planning Process**
 - **Developing Software Estimates Process Document**
 - **FSW Cost Estimation Process Document**
 - **FSW Staff Planning and Metric Spreadsheet Tool**
 - **System Engineering Process**
 - **COTS/GOTS Evaluation and Selection Process Document**
 - **Requirements Engineering Process**
 - **Defining Detailed Software Requirements Process Document**
 - **FSW Requirements Document Template**
 - **Software Requirements Documentation Guidelines**
 - **Testing Process**
 - **Test Procedure Guidelines**
 - **FSW Test Plan Template**
 - **Training Process**
 - **Software for Project Managers Course (awareness training)**

** To date, over 70 procedures, tools, guidelines and templates have been identified for development through the SPI.*



CMMI... Where are you ?



What Progress Was Made With Reduced Funding?

Accomplishments:

Planned FY03 work was prioritized and continued as funding allowed

Majority of funding devoted to Flight Software improvements. Needed process documentation identified and begun

For ISD, completed earned value deployment/training for several pilot projects; checklists for SRR, PDR, and CDRs completed; etc.

Impacts:

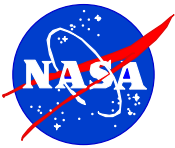
Flight software improvement activities will be delayed

- Had hoped to be close to Level 2 CMMI by fall FY03, will be delayed**

Majority of ISD process documentation will be deferred until FY04 and beyond

Had very little support available for system engineering pilot

Most software acquisition improvement activities deferred until FY04 or later



Flight Software Improvements for FY03 - 04

Formal FSW Standards and Guidelines CCB

- **Initiated June 2003, meets monthly**
- **Objective is to capture and train using FSW-unique terminology and experiences**
How to do the job with minimum risk -- in detail
- **Excellent enthusiasm among staff for common ‘way of doing business’**
- **Schedule for baselining products has been steady but disappointing due to product development delays**

Trying to stay ‘one step ahead’ of new mission milestones

- **FSW Reqmts. Doc. template, FSW Review Standards, ...**
- **FSW Test Plan and associated product templates**
- **CM Plan template, CM Procedure standards, ...**
- **FSW roles responsibility details are being baselined and put into performance plans**
- **Risk mgmt. database, FSW status reporting template, FSW cost estimation, ...**



Flight Software Improvements for FY03 - 04

Common FSW Process Tools

- Looking at highly integrated products -- perhaps RationalRose
 - Reqmts. Management
 - CM
 - DCR tool
- Use of these tools on JWST has been extremely valuable, great controls

FSW Reuse Library CCB... moving to planned reuse

- Controlled repository of FSW products
 - Core FSW Executive and Common Applications
 - Design and code; integration tools
 - FSW Requirements, User info, and other documentation
 - FSW Test Products and results
 - FSW Tools
 - FSW products from heritage missions
- Web-based Library tool selected, CCB Chair working on Library processes
- Plan is to baseline FSW Architecture for use on both SDO and GPM missions



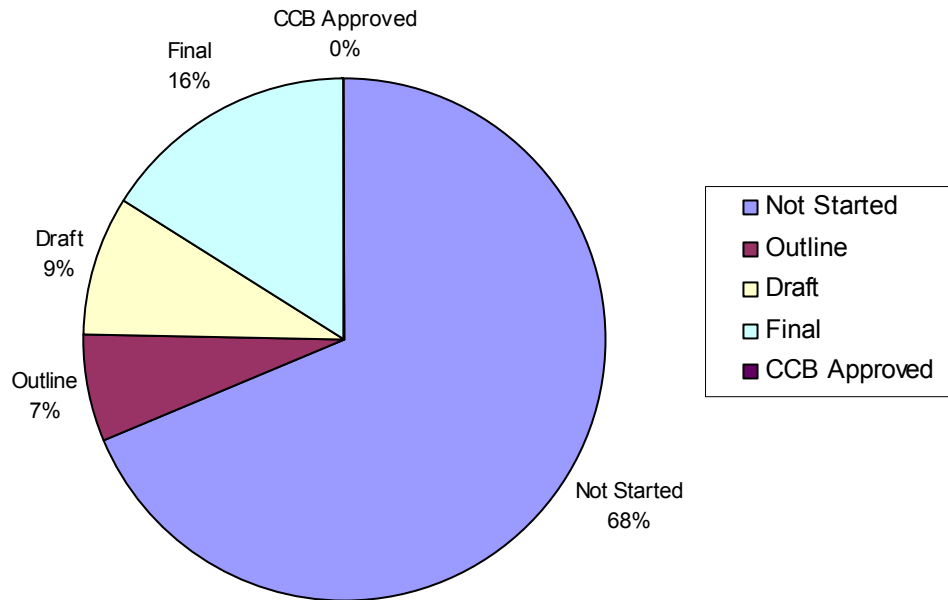
Flight Software (FSW) Progress

- **Many procedures, checklists and templates have been identified to assist flight software personnel with use of best practices**
- **First set FSW templates, checklists are baselined.**
- **Examples:**
 - **CCB Policy, Process**
 - **FSW WBS, Life Cycle Diagram (relationships to Project milestones)**
 - **Product Plan Template**
 - **C, Ada Coding Standards**
 - **FSW Testbed Capabilities Requirements Guidelines**
- **Many more in draft form; several tools have been developed and are in use**
- **New projects (SDO, GPM, JWST) are collecting many more metrics and using them to manage their projects**

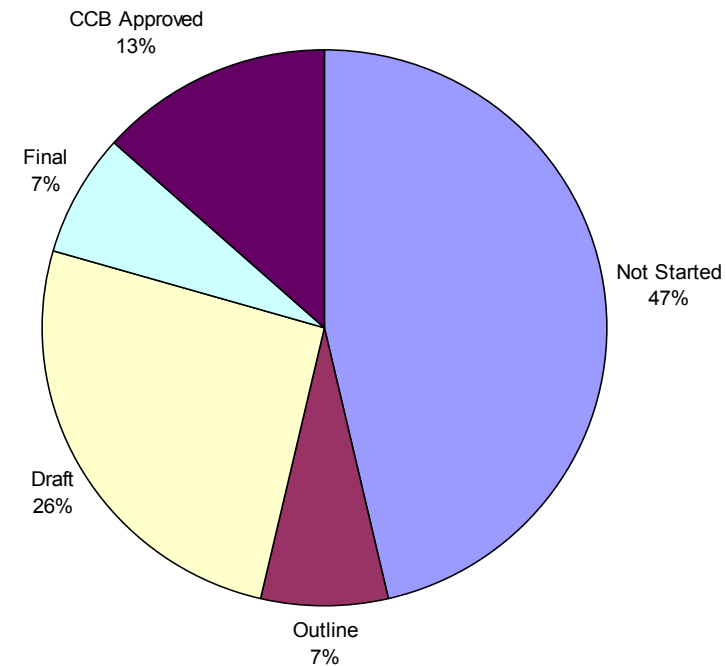


Summary-Process Documentation Progress (FSW/ISD)

Status of ISD Process Assets



Status of Tailored FSW Process Assets





Pending ...

Scope: Mission Software							
CMMI Requirements- FSW Level III in FY07, Others Level III in FY08							
		LEVEL II FSW		LEVEL II-AII LEVEL III-FSW	LEVEL III-AII		
	FY04	FY05	FY06	FY07	FY08	FY09	FY10
FTE (R&TD	4	4	4	4	4	4	4
FTE	4.2	4.2	4.2	4.2	4.2	4.2	4.2
HQ \$	400	400	400	400	400	400	400
GSFC \$	125	600	825	825	825	100	100
	525	1000	1225	1225	1225	500	500
GSFC OG	125	600	825	825	825	100	100
CMMI Requirements- FSW Level III in FY06, Others Level III in FY07							
		LEVEL II FSW	LEVEL II-AII LEVEL III-FSW	LEVEL III-AII			
	FY04	FY05	FY06	FY07	FY08	FY09	FY10
FTE (R&TD	4	4	4	4	4	4	4
FTE	4.2	4.2	4.2	4.2	4.2	4.2	4.2
HQ \$	400	400	400	400	400	400	400
GSFC \$	600	1440	1440	1440	100	100	100
	1000	1840	1840	1840	500		
GSFC OG	600	1440	1440	1440	100	100	100



Technology



ISD Mission and Vision



ISD Mission

Our Core BusinessOur Fundamental Purpose

To provide high value mission information systems products, expertise, and services, and to innovate and apply information technologies for GSFC science missions, measurements, and analysis.



ISD Vision

Picture of our “ideal future”

The ISD is

Valued by flight projects and other customers for providing high-quality full capability information system products, expertise, and services on time and on budget

Forward looking to anticipate and meet future mission information system needs and opportunities in innovative and beneficial ways

Sought after as a value-added partner for enabling new missions and science systems

Recognized for effective quality software processes & practices

Seen as a great place to work with an expert and energized workforce of employees and managers dedicated to customer success



Core ISD Mission Key Enablers

Capabilities that realize mission success

In support of NASA 's Earth and Space science goals, the ISD will:

- Sys & SW Eng** 1) Provide information systems engineering leadership and software engineering expertise to meet mission objectives
- Tech** 2) Enable new missions and extend current mission capabilities through the innovative application of advanced information technologies
- SW Process** 3) Establish, advocate, consistently apply, and improve quality software processes and practices
- SW Products & Services** 4) Create system solutions and first-of-a-kind software products & services which meet or exceed our customer needs

* Mission can imply a flight project, an instrument, a science system, a technology,...



ISD Resource Model

- **To take a snapshot of our current direction in terms of type of work and determine if/where we need to change direction**
- **Categorize by Business type, Project, and Support type**

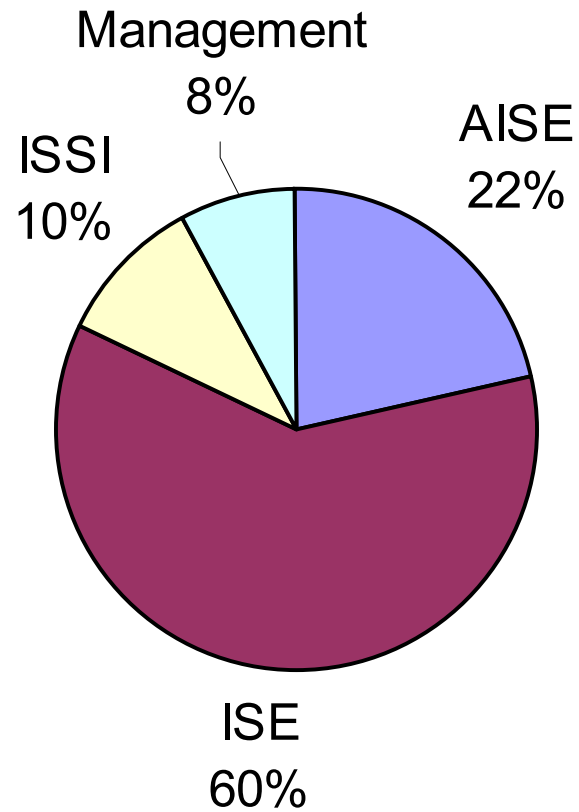


Business Type

- **Advanced Information Systems Engineering (AISE)**
 - Unique
 - Mission request
 - Technology Development
 - Process Improvement Initiative
- **Information Systems Engineering (ISE)**
 - Primary work – Standard
 - Primary work – Specialized
 - Directed work – Standard
 - Directed work – Specialized
- **Information Systems Support/Infrastructure (ISSI)**
 - System Administration
 - Property Management
 - Facilities Management
 - Administrative IT Development
 - Other
- **Management**



ISD Business Type for FY03 (Draft)





Summary Comments



Your Skill, Flexibility, and Energy Is Essential ...

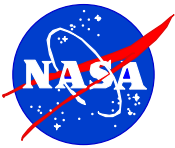
- **ISD customer feedback assembled over the last three months is positive (look to the AETD Dashboard)**
- **Areas in need of help include FSW, Science Labs, and MDs**
Consider a career adventure and help fill important roles !
- **Join in and make GMSEC a success !**
- **We need to assure excellence in software development management, assuring that all our efforts meet fundamental software good practices.**
- **CMMI and SPI are coming. Join in the effort to make it right !**
- **The ISD needs CS leadership and energy to advance actions from the Mission Critical Software colloquiums... take a role in making the recommendations benefit GSFC !**
- **Our future is rich with exciting missions ranging from AURA, Swift, & GLAST through SDO & GPM and onto MMS, COACH, JWST & LISA**
- **Personal & organizational flexibility/agility with domain diversity & skills at working several concurrent efforts shall become ever more important**

Step up to help fill GSFC needs...

Your efforts shall get recognized !



BACKUPS



To Add Critical & Expanded Value

As Chief, I want the ISD ...

- **To be an essential & recognized organization in achieving the GSFC mission**
- **Staff to provide important & broadly recognized technical and management leadership contributions in accomplishing the GSFC mission (from proposals through development and onto operations ... missions and technologies)**
- **To have challenging and exciting work**
- **To define/develop/enable/promote innovation and new technology**
- **To work collaboratively with the Sciences Directorates and other AETD EDs**
- **Line organization to assert & demonstrate responsibility in working with our customers in assuring technical quality for all ISD products and services (responsibility - control)**
- **To become a GSFC resource of choice exceeding our capacity, with appropriate growth**
- **To be viewed as staffed with technical experts and outstanding leaders**
- **Line management to be proactive & innovative in customer support**
- **To reflect a unified/integrated relationship to customers vs. separate Branch pictures**
- **To be seen as having broad hands-on expertise**
- **To staff skills aligned with our work demands**
- **To have very low Branch walls with wide open ISD opportunities**
- **To promote inclusion and diversity in staffing. Lots of fresh outs**

We are in this together & we need all of our resources... for GSFC Mission Success.



Some observations and impressions...

- The area of greatest demand on staffing resources is the area of flight software ... we continue to have demands well exceeding our capacity. Help wanted !
- Science Lab investigator & product support is a growth area if we demonstrate value ... opportunities waiting for initiative & capacity. Pitch in !
- Our Mission Director staffing remains thin. Try something new!
- We remain too reliant on contractors ... we need more CS hands-on contributions
- We need to provide software development management excellence
- I view GMSEC's information bus as key to integrating & facilitating reuse of our diverse flight mission capabilities; enabling continued capability evolution/technology infusion and selected GSFC in-house flight operations
- I value diversity in domain experience ... do P&S, RT command & control, science analysis, embedded systems, ...
- I value the Branch bi-monthly technical status briefings/dialogs...
 - helps inform me, promotes ISD wide management awareness, broadens the exposure of our responsible technical staff to ISD management, promotes Branch identity & ownership, ...
- IT security is big ...
 - System administration responsibilities are being elaborated & exercised
 - ITAR issues will likely change our open information mode of conducting work
 - Web services being consolidated onto security-current servers



CMMI and ISO

- **ISO is a standard, CMMI is a model**
- **ISO is broad- focusing on more aspects of the business. Initially for manufacturing**
- **CMMI is “deep”- provides more in-depth guidance in more focused areas (Software/Systems Engineering/Software Acquisition-SW/SE/SA)**
- **Both tell you “what” to do, but not “how” to do it**
- **But CMMI tells you what “expected” practices are for a capable, mature organization**
- **CMMI provides much more detail for guidance than ISO by including an extensive set of “best practices”, developed in collaboration with industry/gov/SEI**
 - CMMI provides much better measure of quality of processes; ISO focuses more on having processes**
 - CMMI puts more emphasis on continuous improvement**
 - CMMI allows you to focus on one or a few process areas for improvement (It’s a model, not a standard, like ISO) --Can rate just one area in CMMI**
 - CMMI and ISO are not in conflict: ISO helps satisfy CMMI capabilities; CMMI more rigorous**